



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering Syllabus

Subject Code : 3154402

Subject Name : Chemical Reaction Engineering - I

WEF Academic Year :	2021-22
Semester :	5
Category of the Course :	Professional Core

Prerequisite : Basics of Physical chemistry, material and energy balance, and principles of thermodynamics.

Rationale : The objective of this course is to introduce students to the fundamental ideas related to reaction rates. This includes comprehending the process of deriving rate equations from reaction mechanisms, understanding different types of ideal reactors, grasping both integral and differential approaches to analyzing reactions, and becoming familiar with the principles governing the analysis and design of chemical reactors. The course will also cover practical aspects such as experimentally determining rate equations, designing batch and continuous reactors, selecting the suitable reactor type for specific feeds, enhancing selectivity in reactions involving multiple steps, and considering the impacts of temperature and pressure variations, among other relevant topics.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Practical		
				ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content :

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Kinetics of Homogeneous Reactions, Kinetic Model and Temperature Dependency, Introduction and Stoichiometry for the Batch System, Stoichiometry for Constant Volume Flow and Variable Volume Batch Systems, Stoichiometry for Variable Volume Flow System	7	16
2	Analysis of Batch Reactor Kinetic Data, Integral Method of Analysis of Batch Reactor Data, Differential Method of Analysis and Variable Volume Batch Reactor Data	6	14
3	Introduction and Ideal Batch Reactor Design, Ideal Mixed Flow Reactor Design, Ideal Plug Flow Reactor Design	5	12



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4	Size Comparison of Single and Multiple Reactors, Size Comparison Multiple Reactors, Recycle and Autocatalytic Reactors, Recycle and Autocatalytic Reactors	5	10
5	Design for Parallel Reactions, Design for Series Reactions, Design for Series Reactions, Design for Series-Parallel Reactions, Denbigh Reactions and Their Special Cases	5	12
6	Heats of Reaction and Equilibrium Conversion from Thermodynamics, General Graphical Reactor Design Procedure, Material and Energy Balances in Batch Reactor, Optimum Temperature Progression in Batch Reactor	7	12
7	Material and Energy Balances in Plug Flow and Mixed Flow Reactors, Ideal and Non-Ideal Mixed Flow Reactor Design and Multiple Steady States,	5	10
8	Non-Ideal Reactors and Residence Time Distribution, RTD Measurement and Moments of RTD, RTD in Ideal Reactors, Reactor Modeling using the RTD	6	14

Reference Book :

1. Chemical Reaction Engineering by K. A. Gavhane
2. Elements of Chemical Reaction Engineering by H. S. Fogler
3. Chemical Reaction Engineering by Octave Levenspiel

List of Experiments (Any Ten experiments) :

1. To study the operation of Isothermal Batch Reactor
2. To study the operation of Isothermal Plug Flow Reactor
3. To study the operation and principle of Isothermal CSTR
4. To study the operation and principle of Packed Bed Reactor
5. To study and analyze residence time distribution (RTD) in a Packed Bed Reactor
6. To study and analyze residence time distribution (RTD) in CSTR
7. To study and analyze residence time distribution (RTD) in PFR
8. To study the operation of Combined Flow Reactor
9. To study the reactions involved in UV Photo Reactor
10. To determine the activation energy for reaction between ethyl acetate and sodium hydroxide at different temperature
11. To determine the Kinetics of chemical reactions
12. To study and interpret Kinetics of Bio-diesel synthesis from vegetable oils by Transesterification
